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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/473,394	12/28/1999	KAIZAD R. MISTRY	042390.P6892	9930

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EXAMINER

KANG, DONGHEE

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 04/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/473,394

Applicant(s)

MISTRY, KAIZAD R.

Examiner

Donghee Kang

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 March 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 12, 2002 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims **1-3** are rejected under 35 U.S.C. 102(b) as being anticipated by Chau et al. (US 5,434,093).

Chau discloses a field effect transistor, comprising (Fig.3a-e):

a substrate (300) having a recess in a surface thereof, the recess having a bottom portion and substantially vertical sidewalls; a gate dielectric layer (312) disposed superjacent the bottom portion of the recess and adjacent the substantially vertical sidewalls; a gate electrode (314) overlying the gate dielectric layer, wherein the gate electrode conforms to the recessed channel; and source/drain terminals (315 & 316) disposed in the substrate in alignment with a pair of laterally opposed gate electrode

sidewalls, said gate electrode extending to a less shallow depth (315) within said substrate than a depth at which the source/drain terminals are disposed; wherein the source/drain terminals comprise an extension which extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds and extends downwardly, from approximately the surface of the substrate, along the sidewalls of the recess.

4. Claims 7-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Hsu (US 5,448,094).

Hsu discloses a field effect transistor comprising (Fig. 2G):

a substrate (20) having a recess in a surface thereof, the recess having a curvilinear shape; a gate dielectric layer (27) disposed the curvilinear recess; a gate electrode (28a) overlying the gate dielectric layer, wherein the gate electrode conforms to the recessed channel and a portion of the gate electrode that overlies an innermost portion of the source/drain extension; and source/drain terminals (30) disposed in the substrate in alignment with a pair of laterally opposed gate electrode sidewalls, wherein the source/drain terminal comprise an extension (31) which extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds and extends downwardly, from approximately the surface of the substrate, along the curvilinear sides of the recess.

5. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang (US 5,567,966) in view of Chau (US 5,434,093).

Regarding claim 4, Hwang discloses a field effect transistor comprising (Fig. 6):

a substrate having a recess in a surface thereof, the recess having a bottom portion and tapered sidewalls, the tapered sidewall surface forming an obtuse angle with respect to the bottom portions of the recess; a gate dielectric layer disposed the bottom portion of the recess and adjacent the tapered sidewalls; a gate electrode overlying the gate dielectric layer; and source/drain terminals (24) disposed in the substrate in alignment with a pair of laterally opposed gate electrode sidewalls, wherein the source/drain terminal have an extension (22) which extends downwardly, from approximately the surface of the substrate, along the sidewalls of the recess. Hwang does not teach the extension extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds.

Electric fields tend to be increased at small geometries, since device voltages are difficult to scale to arbitrarily small values. As a result, various hot carrier effects appear in short-channel devices. It is well known in the art that forming the lightly doped drain (LDD) structure which decreases the field between the drain and channel regions, thereby reducing injection into the oxide, impact ionization, and other hot electron effects. The LDD uses two doping levels, with heavy doping over most of the source and drain areas but with light doping in a region adjacent to the channel where the depth of heavily-doped region can be made somewhat greater than lightly-doped region without adversely impacting the device operation and gate electrode overlies an innermost portion of the source/drain extension since it is further away from the channel and also taught by Chau this limitation in Fig.3. The increased junction depth lowers both the sheet resistance and the contact resistance of the drain. Hence it would have

been obvious to one having ordinary skill in the art at the time the invention was made to combine the teaching of Chau with Hwang's device to have the shallow lightly-doped region since it absorbs some of the potential into the drain and thus decreases the electric field.

Regarding claims **5-6**, Hwang discloses a portion of the gate electrode overlies an innermost portion of the source/drain extension, wherein the gate electrode conforms to the recessed channel.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Donghee Kang, Ph.D.
April 15, 2002

Steven Loke
Primary Examiner

